

University of Colombo School of Computing

Bachelor of Science in Computer Science

First Year Examination — Semester I

ENH1301 — Application Laboratory

Sample Paper B — Marking Scheme

Two (2) Hours

Answer All Questions

Number of Pages = 8

Number of Questions = 4 _____

To be completed by the candidate

Index Number

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Important Instructions to candidates

- The students are required to answer all questions within two hours.
- The medium of instructions and questions is English.
- You shall write your answers in **English**.
- This paper has **4** questions on **8** pages.
- Answer **all 4** questions.
- **Write your answers on and only on the space provided** on this question paper.
- Write your index number on each and every page of the question paper.
- Do not tear off any part of this answer book. Under no circumstances may this book (or any part of this book), used or unused, be removed from the Examination Hall by a candidate.
- Questions appear on both sides of the paper. If a page is not printed, please inform the supervisor immediately.
- Any electronic device capable of storing and retrieving text, including electronic dictionaries and mobile phones, are **not allowed**.
- Calculators are **not allowed**.

To be completed by
the examiners

1	
2	
3	
4	
Total	

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1.

(a). Consider the following directory hierarchy and sequence of commands executed in an Ubuntu GNU/Linux terminal.

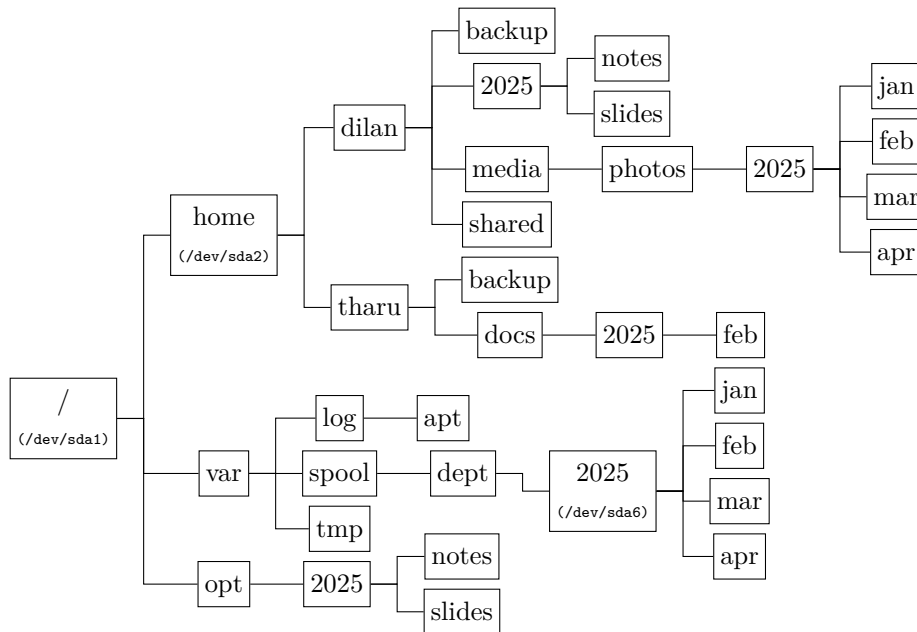


Figure 1: Extract of an Ubuntu GNU/Linux directory structure

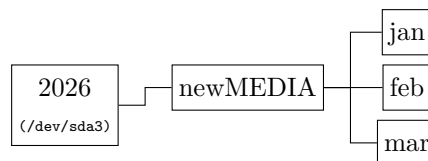


Figure 2: Extract of an Ubuntu GNU/Linux directory structure of /dev/sda3 partition

Assume you logged in as **dilan** and executed the following commands, and /var/spool/dept/ is accessible for **dilan** to write.

\$ cd media/photos/2025	①
\$ cp feb mar	②
\$ ls -l	③
\$ pushd /var/spool/dept/2025	④
\$ echo \$?	⑤
\$ sudo cd /opt/2025	⑥
\$ ls ..	⑦
\$ popd	⑧
\$ cd ../../	⑨
\$ mkdir -p 2026	⑩
\$ sudo mount /dev/sda3 /home/dilan/media/2026	⑪
\$ _____	⑫

Example question and answer:

Q: What is the outcome of the command ①?

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Ans: User **dilan** change directory to **media/photos/2025**

Use the Figure 1 and sequence of commands given to answer the following sub questions.

Output: Write the output you will see in the STDOUT

Outcome: Write the result you get by executing a particular command

- i. What is the outcome of command ②? [2 marks]

The command fails. `cp` will not copy a directory unless `-r` is given, so the shell reports

`cp: -r not specified; omitting directory 'feb'`
and nothing is copied.

- states the copy fails / nothing is copied [1]
- reason: `feb` is a directory and `-r` was not given [1]

- ii. What is the output of the command ③? [2 marks]

One name per line, in alphabetical order:

`apr`
`feb`
`jan`
`mar`

- all four directories listed [1]
- one per line (`-1`) and sorted alphabetically [1]

- iii. What is the output of the command ⑤? [2 marks]

`0`

- `$?` holds the exit status of ④; `pushd` succeeded, and zero means success [2]

- iv. What is the output of the command ⑦? [2 marks]

`2025`

- recognises that ⑥ failed — `cd` is a shell builtin and cannot be run through `sudo` — so the working directory is still `/var/spool/dept/2025`; `..` is `/var/spool/dept`, which contains only `2025` [2]

- v. Explain the purpose of the command ⑪? [2 marks]

Attaches the filesystem on the partition `/dev/sda3` to the directory `/home/dilan/media/2026`, which becomes its *mount point*. After this, the contents of that partition shown in Figure 2 — **newMEDIA** and the month directories beneath it — are reachable through that path. `sudo` is required because mounting needs administrative privileges.

- mounts / attaches the `/dev/sda3` filesystem [1]
- makes its contents accessible under the given mount point [1]

- vi. **dilan** used the command ⑫ to create a symbolic link named **latest** in the current directory, pointing to `/var/spool/dept/2025`. Write the command? [2 marks]

`ln -s /var/spool/dept/2025 latest`

- `ln -s` [1]
- target before link name, in that order [1]

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(b). Consider the Figure 3 to answer the sub questions.

Filesystem	Size	Used	Avail	Use%	Mounted on
/dev/sda1	48G	21G	25G	46%	/
/dev/sda2	196G	88G	99G	48%	/home
/dev/sda6	92G	61G	27G	70%	/var/spool/dept

Figure 3: Screen capture

i. Write the command `dilan` has to issue to get the output of Figure 3? [2 marks]

`df -h`

• `df` [1]

• `-h` for the human-readable sizes shown [1]

ii. Explain what the column “Mounted on” shows, and state which line of Figure 3 corresponds to the partition marked `/dev/sda6` in Figure 1. [4 marks]

“Mounted on” gives the *mount point* of each filesystem — the directory through which that filesystem’s contents are reached in the single directory tree.

The third line, `/dev/sda6 ... /var/spool/dept`, is the partition marked in Figure 1; everything under `/var/spool/dept` lives on it rather than on the root filesystem.

• mount point — the directory that gives access to the filesystem [2]

• identifies `/dev/sda6` mounted on `/var/spool/dept` [2]

(c). What is the command that can be used to find the total size occupied by a directory and everything inside it, in human readable form? [2 marks]

`du -sh <directory>` (for example `du -sh media/`)

(d). What is the command that can be used to display the running kernel version of a GNU/Linux system? [2 marks]

`uname -r` (also accept `uname -a`)

(e). `dilan` wants the `/dev/sda3` partition to be mounted automatically every time the system boots, instead of typing command ⑪ each time. Which file must be edited to achieve this? [3 marks]

`/etc/fstab`

• `/etc/fstab` [2]

• recognises that editing it requires root privileges [1]

Question 1 total: 25 marks

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2.

(a). Given below is a US QWERTY keyboard and answer the sub questions using the knowledge of touch typing.

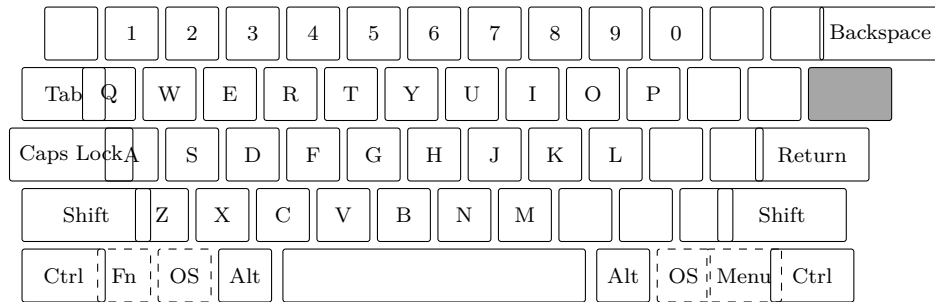


Figure 4: *QWERTY Keyboard*

i. Write letters of **three (03)** keys typed by using the **middle finger** of your **left hand**. [3 marks]

E, D, C (the digit 3 is also on this finger)

• one mark for each correct key [3]

ii. Write letters of **four (04)** keys typed by using the **index finger** of your **left hand**. [4 marks]

Any four of: R, T, F, G, V, B (the digits 4 and 5 also belong to this finger)

• one mark for each correct key [4]

(b). The command `ls` in a directory produced the following output.

```
data1.log  data2.log  data10.log  Draft.txt
draft.txt  report.md  temp.bak    temp.log
```

i. Write a single command that lists **only** `data1.log` and `data2.log` from this directory. [3 marks]

`ls data?.log` or `ls data[0-9].log`

• a wildcard matching exactly one character in that position [2]

• excludes `data10.log` [1]

ii. What is the output of the command `ls [Dd]raft.txt` in this directory? [2 marks]

`Draft.txt` `draft.txt`

• both files — the bracket set matches either case [2]

(c). Everything in Linux is a file. The result of `ls -l /home/dilan/project/` is given below.

```
-rw-r--r-- 1 dilan cs      9421 Mar 03 2025 readme.md
drwxrwxr-x 3 dilan cs      4096 Mar 11 2025 build
-rwxr-sr-x 1 dilan cs     33180 Feb 20 2025 compile
lrwxrwxrwx 1 dilan cs         9 Mar 11 2025 current -> readme.md
drwxrwxrwt 5 root  root     4096 Mar 12 2025 scratch
```

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- i. `dilan` executed `chmod 754 readme.md`. Write the new permissions of the file `readme.md` in the same format as the `ls -l` output? [2 marks]

`-rwxr-xr-`

- owner `rwx`, group `r-x` [1]
- others `r-`, and the leading `-` for a regular file [1]

- ii. Explain the meaning of the `t` that appears at the end of the permissions of the directory `scratch`? [3 marks]

It is the *sticky bit*. The directory is writable by everyone (`rwxrwxrwx`), but the sticky bit means only the **owner** of a file inside it — or **root** — may delete or rename that file. `/tmp` is set up the same way.

- sticky bit — only the file's owner may delete it [2]
- in spite of the directory being world-writable [1]

- iii. The directory `build` shows a link count of 3. Explain what that number counts for a directory. [3 marks]

For a directory the link count is the number of entries that point at it: its own `.`, the entry for it in its parent directory, and one `..` for every sub-directory it contains. A count of 3 therefore means `build` holds exactly one sub-directory.

- counts `.`, the parent's entry, and each child's `..` [2]
- concludes that `build` contains one sub-directory [1]

(d). `dilan` needs to transfer a file to a remote server over SSH.

- i. Write the command to copy the local file `results.csv` into the directory `/home/dilan/` on the host `192.168.1.50`, logging in as the user `dilan`. [2 marks]

`scp results.csv dilan@192.168.1.50:/home/dilan/`

- ii. The attempt fails with `Connection refused`. Give **two (02)** things `dilan` should check on the server. [3 marks]

1. That the SSH server is installed and running — `sudo systemctl status ssh`, and `sudo systemctl start ssh` if it is not.
2. That something is listening on port 22 — `sudo ss -tln | grep :22` — and that the firewall allows it, `sudo ufw allow 22`.

- the `sshd` service is running [1.5]
- port 22 is open / not blocked by the firewall [1.5]

Question 2 total: 25 marks

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3.

(a). Write the key or key combinations or commands to achieve the given tasks in a **vim** editor command mode.

- i. Move the cursor to the end of a line. [2 marks]

`$`

- ii. Copy (yank) the current line. [2 marks]

`yy`

- iii. Move the cursor 40 lines up. [2 marks]

`40k`

- iv. Divide the vim editor view vertically and open a new file named **notes**. [2 marks]

`:vsp notes` (or `:vsplit notes`)

- v. Replace every occurrence of the word **alpha** with **beta** in the whole document, asking for confirmation at each occurrence. [4 marks]

`:%s/alpha/beta/gc`

- `%` — every line in the file [1]
- `s/alpha/beta/` — the substitution itself [1]
- `g` — every occurrence on each line, not just the first [1]
- `c` — confirm each replacement [1]

- vi. Navigate backward to the previous spelling mistake in the vim spellchecker. [2 marks]

`[s`

- vii. Navigate to the bottom of the document. [2 marks]

`G`

- viii. Redo a modification that has just been undone. [2 marks]

`Ctrl+R`

- (b). Write **two (02)** situations where you would use **git log**. [4 marks]

1. To review the history of a project — who changed what, when, and with what commit message — for example before merging a branch.
2. To find the identifier of an earlier commit, so that it can be inspected with **git show**, reversed with **git revert**, or returned to.

- any reasonable use involving reading the commit history [2]
- any reasonable use involving locating a particular commit [2]

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(c). What is the use of the `.gitignore` file?

[3 marks]

It lists patterns for files Git should never track — build output, log files, and anything containing secrets. Such files then stop appearing as untracked in `git status` and are never committed by `git add` .

It only affects files that are *not already* tracked: adding a file to `.gitignore` after it has been committed does not remove it from the history.

- names files/patterns that should not be tracked or committed
- gives a sensible example, or notes it does not affect tracked files

[2]

[1]

Question 3 total: 25 marks

- 4.
- (a). L^AT_EX is a powerful tool for technical writers. Write the output of the L^AT_EX script combined with the other files given.

<pre>\documentclass[11pt]{article} \usepackage{listings} \usepackage{natbib} \title{Laboratory Report} \author{D. Silva} \date{} \begin{document} \maketitle \section{Method} Water boils at \$100^\circ\text{C}\$, and 5\% of the sample remained \textbf{unchanged} \cite{silva2024io}. \begin{itemize} \item Prepare \item Measure \end{itemize} \begin{table}[h!] \caption{Timings} \begin{tabular}{lrr} \hline Run & Start & End \\ \hline 1 & 09:00 & 09:45 \\ 2 & 10:00 & 10:20 \\ \hline \end{tabular} \end{table} \lstinputlisting[language=HTML]{ page.html} \bibliography{ex} \bibliographystyle{ieeetr} \end{document}</pre>	<pre><html> <body> <h1>Results</h1> </body> </html></pre>	<pre>@article{ silva2024io, author = {Silva, Dilan and Perera, Amaya}, title = {Measuring Input Latency}, journal = {Applied Computing Letters}, year = {2024}, volume = {6}, number = {1}, }</pre>
ex.tex	page.html	ex.bib

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1. **A title block**, because `\maketitle` is present: the title **Laboratory Report** centred and in a large font, the author *D. Silva* beneath it, and **no date** — `\date{}` is empty, so the date is suppressed rather than defaulting to today.

2. **A numbered section heading** reading **1 Method**.

3. **Body text** as one paragraph:

“Water boils at 100°C, and 5% of the sample remained **unchanged** [1].” — the degree symbol raised as a superscript, a literal per-cent sign (it is escaped as `\%`), *unchanged* in bold, and a **numeric** citation [1] in square brackets because the style is `ieeetr`.

4. **A bulleted list**:

- Prepare
- Measure

5. **A table** placed at that point because of `[h!]`, with the caption **Table 1: Timings** *above* it — the `\caption` comes before the `\tabular`. The `\tabular` has three columns, the first left aligned and the other two right aligned, with **no vertical rules** and three horizontal rules. Contents: heading row *Run, Start, End*, then *1 09:00 09:45* and *2 10:00 10:20*.

6. **The contents of `page.html`** typeset verbatim in a monospaced font, all five lines exactly as written including the indentation. The HTML is *not* rendered — the word “Results” appears surrounded by its `<h1>` tags, not as a heading.

7. **A References section** at the end, with the single numbered entry:

[1] D. Silva and A. Perera, “Measuring input latency,” *Applied Computing Letters*, vol. 6, no. 1, 2024.

(`ieeetr` abbreviates given names to initials and lower-cases the title. Accept any answer that gives a numbered References list containing this one work — do not penalise the exact punctuation.)

- title and author shown, and no date, because `\date{}` is empty [3]
- numbered section heading *1 Method* [2]
- superscript degree, literal %, bold text [3]
- numeric citation [1] in square brackets, from `ieeetr` [2]
- bulleted (not numbered) list [2]
- caption *above* the table; no vertical rules; column alignments [3]
- `page.html` reproduced verbatim, HTML not rendered [2]
- numbered References entry [1]

(b). A student compiled the above document by running `pdflatex ex.tex` once only. State **two (02)** things that would be wrong in the resulting PDF, and write the full sequence of commands needed to produce a correct `ex.pdf`. [4 marks]

What would be wrong: the citation would appear as [?] rather than [1], and the References section would be missing — `bibtex` has not run, so there is no `.bbl` file for L^AT_EX to include.

Correct sequence:

```
pdflatex ex.tex
bibtex ex
pdflatex ex.tex
pdflatex ex.tex
```

- citation unresolved, shown as [?] [1]
- no References section produced [1]

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- correct four-command sequence, with `bibtex` `ex` taking no extension

[2]

(c). A LibreOffice Calc sheet holds a student's mark in cell B2, and a bonus that applies to the whole class in cell D1. Write the formula for cell C2 that adds the bonus to the mark and rounds the result to one decimal place. The formula must still be correct after it is copied down to C21. [3 marks]

`=ROUND(B2+$D$1,1)`

- `ROUND(...,1)` for one decimal place
- B2 left relative, so it follows each row
- `$D$1` — an absolute reference, so it does not shift when copied down

[1]

[1]

[1]

Question 4 total: 7 marks

Total marks accounted for in this paper: 82